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A BIOLOGICAL EVALUATION OF DISEASE PROBLEMS AT THE FOREST SERVICE HUMBOLDT NURSERY

John Kliejunas, Plant Pathologist
James Allison, Plant Pathologist

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ABSTRACT

A tip blight and canker of 1-0 and 2-0 true fir at the Forest Service Humboldt Nursery were examined in order to determine the cause and to suggest alternative methods for stopping or slowing its spread and impact. A fungus identified as a Phoma sp., morphologically identical to the Phoma sp. associated with blight of Douglas-fir at the nursery, was consistently isolated from affected tissues. Fusarium oxysporum was associated with necrotic rootlets. Alternatives for reducing the impact of the disease, including 1) sanitation and 2) the use of chlorothalonil and/or a fixed copper fungicide, are presented.

INTRODUCTION

At the request of Assistant Nursery Manager Cindy Henchell, pathologists John Kliejunas and James Allison of the Forest Pest Management Staff visited the Forest Service Humboldt Nursery at McKinleyville on January 25 and 26, 1982. The objective of the trip was to observe a problem of uncertain cause affecting 1-0 and 2-0 true fir in the nursery beds and to suggest methods for stopping or slowing its spread and impact. On the morning of January 26 the disease in true fir was discussed with Keith Whalen, a student at Humboldt State University who had been working on the problem since last fall. Other disease problems or potential disease problems were also observed and discussed with nursery personnel.

OBSERVATIONS

TRUE FIR

Beds of 2-0 red fir had scattered seedlings with the top one-third or more of the main stem dead. Definite sunken cankers were present on some stems, but no fungus fruiting bodies were observed. The dieback was apparently most active last summer and early fall; no currently active dieback was observed. The root systems of affected seedlings were healthy and vigorous. Other seedlings which were completely dead had a Fusarium species, possibly a secondary invader of dead tissues, fruiting at the root collars. Chlorothalonil was applied last summer to the 2-0 beds with no apparent affect on disease incidence. Affected seedlings were rogued as dieback occurred.

The symptoms were similar to those observed last spring by John Kliejunas; a Phoma sp. was isolated from the canker margins at that time. The same symptoms were observed in 1979 and 1980 by Art McCain, plant pathologist at the University of California at Berkeley, and Mike Srago, Regional regeneration specialist; a Phoma sp. was isolated from the stems and a Fusarium sp. from the root collars.

The 1-0 beds of red fir were more severely affected. Randomly scattered patches of dead and dying seedlings occurred in roughly circular patterns. The patches were conspicuous because of the bright red color of needles on affected seedlings. The patches were first noticed by nursery personnel early last fall. The disease intensified and spread during the last few months, which coincides with the rainy season. Current loss in the affected beds was estimated at 15%, with an additional 18% mortality - based on chlorotic appearance of seedlings - expected. The disease symptoms in the 1-0 beds had not occurred in prior years.

Smaller, stunted seedlings were entirely top-killed. On the larger seedlings, a dieback or blight of terminals and side branches occurred. The dieback started at or near the buds and then progressed down the stem. The root systems of still living seedlings were extensive and no rootlet necrosis was noted. A Fusarium species - diagnosed on the basis of cortical rot at the root collar, slippage of bark, and the presence of white masses of spores - was observed on dead seedlings.

A few patches of affected white fir were observed adjacent to the affected red fir beds. Current mortality was 2%, with an additional 5% mortality expected.

The 1-0 beds were in an area that was formerly planted to Douglas-fir. When the Douglas-fir were removed, the area was fallowed, planted with a cover crop, then fumigated and sown with red and white fir seeds treated with Busan.

Keith Whalen made the following observations on the disease in the 1-0 and 2-0 true fir beds:

1. Definite sunken cankers are present on affected branches in the fall of the year.

2. Fruiting bodies have not been observed on affected seedlings.

3. A species of Phoma was consistently isolated from the cankers on 2-0 seedlings and from blighted stems of 1-0 seedlings.

4. Fusarium oxysporum was consistently isolated from the roots of stunted 1-0 seedlings, and from the soil. This fungus has never been isolated by Keith from cankers associated with top dieback.

From these observations, Keith has postulated that, in 1-0 beds, F. oxysporum causes a root rot which results in stunting; seedlings affected with root rot are then susceptible to a top dieback or blight caused by a Phoma sp.

Samples from the 1-0 and 2-0 beds were collected by us and taken to the laboratory. Isolations were made to determine the fungi present by incubating affected tissues on various growth media. A Phoma sp. was consistently isolated and a Fusarium sp. was occasionally isolated from stems of 1-0 and 2-0 red fir. A Fusarium sp. was consistently isolated from the roots of affected 1-0 seedlings and from dead 2-0 seedlings. The Phoma sp. from red fir was morphologically identical to a species of Phoma isolated from Douglas-fir seedlings.

OTHER DISEASE PROBLEMS

Phoma blight of Douglas-fir was observed in a few beds. No spray program with chlorothalonil is currently in use at the nursery. Observations by Tim Capistrant, Nursery Manager, suggest that the disease is less severe in dense beds. This observation should be documented. The disease is prevalent enough in the nursery that, if a fungicide alternative to chlorothalonil was available for control, it would be used. The nursery is reluctant to use chlorothalonil because the fungicide has been detected in the county water supply after the storage pond for the nursery overflowed during heavy rains.

Sirococcus tip blight, caused by Sirococcus strobilinus, was prevalent in two beds of Jeffrey and ponderosa pine. Approximately 15% of the seedlings have been lost as a result of the disease. Infected seedlings have been rogued, but local spread within the beds is still occurring. Again, no spray schedule is practiced, and an alternative to chlorothalonil is needed.

MANAGEMENT CONSIDERATIONS

The tip blight and canker on true fir is associated with a species of Phoma. Pathogenicity of the isolate, as well as the involvement of Fusarium root rot in the complex, is currently being studied by Keith Whalen. FPM is enlisting the help of the University of California to initiate field

testing of systemic fungicides that may be effective against Phoma. The testing should give an alternative to chlorothalonil as a control for Sirococcus tip blight as well.

Until fungicides other than chlorothalonil are tested for efficacy and their use in California is approved, various alternatives are available to the nursery to reduce the impact of the disease on true fir and to reduce levels of Sirococcus tip blight on pines.

1. Do nothing. The disease in true fir will continue to spread locally, depending on environmental conditions. Beds to be planted to true fir this April may become infected and losses will intensify in the present 1-0 beds. Losses of pines to Sirococcus tip blight have been severe in past years at the nursery when fungicide spray schedules were not used. Based on this past information, Sirococcus tip blight can be expected to increase if chlorothalonil or an effective alternative fungicide is not used.

2. Sanitation. Sanitation should be a standard procedure to eliminate or minimize pest populations in the nursery. This includes roguing diseased seedlings in nursery seedbeds along with the elimination of pest host plants in and around the nursery to reduce fungus inoculum. Roguing of diseased true fir, with a host-free strip between diseased patches and healthy seedlings, should reduce local spread of the disease. A more thorough roguing of Sirococcus-infected pines should reduce local spread by spore dispersal in splashing water droplets. The source of Sirococcus infection in the nursery has been demonstrated to be cones of Sitka spruce planted as windbreaks at the nursery margin. Removal of the spruce would eliminate the source of long distance recurring infection.

3. Use of currently available fungicides. Field tests of various fungicides to control Phoma blight on Douglas-fir at the nursery were conducted in the early 1970's. Difolatan, which is not currently registered for ornamental use, eliminated the disease. Chlorothalonil and COCS (copper oxychloride sulfate) also gave effective control. Chlorothalonil, applied at two- to four-week intervals from October to April, has since been shown to be an effective control for Phoma blight on Douglas-fir at the nursery. Chlorothalonil and/or a fixed copper fungicide should slow the spread of the disease in true fir until Difolatan is registered and/or newer systemic fungicides are tested and registered.

Similar field tests for control of Sirococcus tip blight were conducted in 1970 and 1971. Although chlorothalonil was most effective, Difolatan and mancozeb (Dithane M-45) were also effective.

Sanitation and the use of fungicides are not mutually exclusive. An integrated control approach, consisting of a concerted combination of preventive, cultural, biological, and chemical procedures, represents the most effective and efficient means of nursery pest management. An active surveillance and monitoring program to detect potential pest problems and to determine their impact is also essential.